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Patents ADP number *(if you know it)* 8569824001

If the applicant is a corporate body, give the country/state of its incorporation

4. Title of the invention

Headgear

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"Address for service" in the United Kingdom to which all correspondence should be sent *(including the postcode)*

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MATHYS & SQUIRE 15 January 2004

12. Name and daytime telephone number of person to contact in the United Kingdom: Michael C Moir - 020 7830 0000

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HEADGEAR

The present invention relates to headgear. In particular, the invention relates to a personalised internal cap for a helmet, a helmet comprising a personalised internal cap, a method of manufacturing such a helmet and protective apparel comprising such a helmet, wherein the internal cap is personalised such that the helmet sits in a predetermined position on a wearer's head.

The invention is particularly suitable for the fitting of helmets for pilots of military aircraft. Such helmets typically comprise an outer protective helmet and, attached to the outer helmet, a helmet mounted display system. Such systems require exact and repeatable placement of images in front of the wearer's eyes during flight. A poorly-fitting helmet tends to move relative to the head during use, thus causing the display to be displaced out of the line of sight of the wearer. A poorly-fitting helmet also causes the weight of the helmet to be focussed on pressure points, resulting in user discomfort.

However, in certain applications, it is necessary for the wearer to wear additional clothing to protect him from the environment in which he is to work. In particular, a protective hood might be worn under the helmet. This may result in the helmet not sitting in the necessary position for acceptable operation of the external equipment.

It is an aim of at least some embodiments of the invention to overcome or alleviate this and/or other problems.

Therefore, in accordance with a first aspect of the invention, there is provided a personalised cap for a helmet, the cap being bespoke to a specific wearer so as precisely to fit the helmet to the wearer's head, the cap comprising a crown portion and a separate brow portion, the crown and brow portion being contiguous with each other.

Preferably, the brow portion interlocks with the crown portion, so that relative

movement of the portions in use may be minimised.

Preferably, at least one said portion is of impact or energy absorbing material. This may result in increased protection of the head of a wearer.

Preferably, the brow portion is thinner than the crown portion, since this may allow for the mounting of helmet-mounted equipment closer to the eyes of a wearer and and for the distance of an image presented by a helmet mounted display from the eyes of a wearer to be constant.

Preferably, the brow portion is of a different impact or energy absorbing material to the crown portion.

A second aspect provides a helmet comprising a personalised cap as set out above.

Preferably, a brow portion of the helmet is of a smaller radius than a crown portion to permit the attachment over the helmet brow portion of a helmet-mounted display equipment. This also may result in the location of the equipment close to the eyes of the wearer of the helmet.

Preferably, the brow portion of the cap is removable from the helmet without disturbing the crown portion, whereby one brow portion can be substituted for another.

A further aspect provides a method of manufacturing a helmet comprising a personalised internal cap which positions the helmet on the wearer's head, the method comprising a prior determination of the shape of the wearer's head by a measurement device followed by the production of a kit of parts for assembly into said personalised cap, the kit comprising a crown portion and alternative brow portions, a first said brow portion conforming to the wearer's head when wearing an environmental protection hood, and a second said brow portion conforming to the wearer's head without said hood.

Preferably, the measurement device is a non-contact measuring device.

Preferably, during the prior determination the relative positions of the wearer's eyes and the measured portion of his head are determined.

Yet a further aspect provides a kit of parts for precisely fitting a helmet to a wearer's head, the kit comprising a crown portion and first and second brow portions of a personalised internal cap which position the helmet on the wearer's head, the first and second brow portions having respectively been produced to align the helmet on the wearer's head to a predetermined position relative to his eyes when the wearer respectively is wearing and is not wearing an environmental protection hood.

The individual components of the kit of parts may also be provided separately, or in any combination. Thus the invention also provides a crown portion of a personalised cap for a helmet, the crown portion conforming to the shape of a wearer's head. The invention also provides, independently, first and second brow portions of a personalised cap for a helmet, the brow portions conforming to the shape of a particular wearer's head when not wearing and when wearing an environmental protection hood, respectively.

Preferably in such a method or kit of parts, the crown portion engages the first brow portion or the second brow portion to form the personalised internal cap.

A related aspect of the invention provides a helmet comprising a personalised internal cap formed from a kit of parts as set out above, and a further aspect provides protective apparel comprising such a helmet or a helmet as set out above.

Yet a further aspect of the invention provides an environmental protection hood for use under a protective helmet, comprising an aperture containing a window adjacent the periphery of which is provided means for engaging with an opening in a helmet.

In this way, the window may be positively located with respect to the helmet. This may result in the minimising of optical effects due to a wearer looking through both the window and the visor of the helmet.

The window is preferably reversibly removable from the hood. This may allow for increased comfort in the event the hood is donned out of anticipated rather than actual necessity. In which case, the window might be removed until necessity for the hood arises, thereby keeping the wearer cooler.

In an example, engaging means are provided for engaging with and retaining the window, which engaging means are preferably mounted on a rigid frame.

Preferably, the hood further comprises fittings for engaging with a respiratory mask to locate such a mask when used by a wearer of the hood. The provision of fittings on the hood for attaching a mask rather than attaching the mask to the helmet may divorce the location of the mask from that of the helmet, in a hood formed of a flexible material. This may provide increased comfort for the wearer, particularly when under exertion.

Preferably, the hood further comprises a removable mask portion. The provision of a removable mask portion of the hood, for example, around the mouth (and preferably nose) of the wearer, such that when the portion is removed the mouth (and nose) are exposed, may increase the comfort of the wearer of the hood in an analogous way as the provision of a removable window.

Preferably, the mask portion comprises a further rigid frame adapted to seal against the rigid frame. This may allow the removable mask portion to be reattached to the main body of the hood rapidly and securely.

The fittings for attaching a mask are preferably provided on the rigid frame of the mask portion, since this may allow the mask portion and mask to be attached and removed in one operation.

Yet a further aspect of the invention provides an environmental protection hood for use over a helmet and a respiratory mask, the hood being adapted to entirely enclose the helmet and mask.

Such a hood may eliminate the need for decontamination of a helmet and mask or for the discarding of the helmet and mask, which may be necessary when using hoods in which the helmet and mask are exposed. In addition, masks used with such a hood need themselves be protective, and a wearer may use a single mask regardless of whether a hood is to be worn.

The hood comprises an aperture having situated therein a window through which a wearer of the hood may see, a selectively releasable seal being provided adjacent an edge of the window such that an opening may be made in the hood. In this way, the wearer of the hood may easily create an opening in the hood in conditions where the wearing of the hood is not necessary (but may be anticipated), thereby increasing his comfort. This feature is also provided independently.

The hood may preferably be worn with a helmet having a front portion which may be raised and lowered by the wearer and it therefore preferably comprises means for engaging the window with a raisable front portion of a helmet, such that when the hood and helmet are worn together, the window and the front portion of the helmet may be raised and lowered together. This may further server to increase the comfort of the wearer.

Preferably, the hood further comprises fittings for engaging with a respiratory mask to locate such a mask when used by a wearer of the hood.

Hoods in accordance with the preceding aspects of the invention (whether for use over of under a helmet) preferably further comprise a sleeve adapted to receive a hose for delivering air to a respiratory mask worn by a wearer of the hood. In this way, it is not necessary that the hose itself is protective since it is enclosed by the

sleeve. A single hose may therefore be used regardless of whether a hood is to be worn. This feature is also provided independently.

The sleeve is preferably formed of the same material as the hood so that it too forms part of the enclosure of the hood, which thereby also protects the hose.

Preferably, the distal end of the sleeve with respect to the aperture of the hood has means inside the sleeve for engaging with a hose by means of which the hose may be fed with air and means outside the sleeve for engaging with an air supply means of an aircraft, by means of which the hose may be fed with air.

The sleeve preferably further comprises at its distal end means for attaching a further hose for providing demisting air to the hood adjacent the head of a wearer and has a further hose for providing that demisting air which runs within the sleeve from its distal end to a portion of the hood adapted in use to be adjacent the head of a wearer, where it may be directed, for example, onto the inside of the window of the hood.

A further aspect of the invention provides a respiratory mask air supply hose comprising enclosure means forming a conduit through which air may pass and structural means for maintaining the cross-section of the conduit, the enclosure means being formed of different material.

In comparison with known hoses which are formed entirely of moulded silicone and which have integral ribs to maintain the structure of the hose, such a hose may be made to be lighter by selection of an appropriate material for the structural means, which may in turn result in greatly reduced load on the head of a wearer, particularly under rapid acceleration.

The structural means is preferably formed of a thermoplastic material.

Preferably, the structural means comprising a left-handed helix and a right handed

helix, both helices being coaxial with the conduit. In comparison with known hoses air conduits which have a structural means formed of a single helix, such a structural means may have greater structural stability. This feature is also provided separately.

Preferably, the helices are arranged such that, when the hose is compressed or extended, substantially zero torque around the axis of the hose results In this way, if the user of the hose moves towards or away from an air source to which the hose is attached, the likelihood of accidental detachment of the hose by rotation of the attached end under a resultant torque and the risk of a kink forming in the hose may be reduced.

Preferably, the structural means comprises a plurality of left-handed helices and/or a plurality of right-handed helices. This may allow mechanical characteristics of the hose (e.g. stiffness) to be tailored to particular applications.

A further aspect provides a respirator mask comprising a first portion (which is preferably injection moulded) housing at least one valve and a second portion (for example, formed of silicone rubber) adapted to seal around the nose and mouth of a wearer, the first and second portions being formed of different materials.

Known respirator masks, which are largely formed of a flexible material such as silicone rubber in order to provide sufficient flexibility for the mask to seal around the nose and mouth of a wearer. The rigidity necessary for the portion of the mask housing the inspiratory and expiratory valves and the communications components is achieved by means of larger wall sections. In comparison with such known masks, a mask according to this aspect may be lighter since the necessary rigidity may be achieved by thinner wall sections of a less dense material (e.g. a thermoplastics material such as nylon, PA or POM). In addition, the centre of gravity of the mask may be moved towards the seal of the mask. Both the reduced weight and the movement of the centre of gravity are of particular importance where the wearer of the mask is to be subjected to increased gravitational forces, where they

may result in a reduced load on the neck of the wearer. This may result in the mask being usable in conditions where the wearer is subjected to yet greater gravitational forces. Furthermore, the tension necessary to securely locate the mask in place may be reduced, resulting in greater comfort for the wearer.

Preferably, the first portion of the mask has at least one integrally-formed portion of a valve. This feature is also provided independently. In known masks, the valves are self-contained units made, tested and sold separately and inserted into the mask. The mask is therefore relatively large since it accommodates both the wall thickness necessary to give the structural portion of the mask rigidity and the wall thickness of the valves. The provision of a portion of the valve (for example, a valve seat or a chamber of an inspiratory or expiratory valve) integrally with the portion of the mask may reduce the overall wall thickness of the mask, perhaps resulting in a yet lighter, more compact mask having the advantages set out above. In addition, the reduced number of interfaces between components of the mask may reduce the likelihood of leaks forming around valves.

A final aspect of the invention provides a fitting for attaching a respirator mask to a helmet, the fitting comprising means for engaging with a helmet, and means for receiving webbing for attaching the fitting to the mask, the webbing receiving means being adapted to be movable such that the direction at which webbing in the receiving means extends from the fitting relative to the position of the helmet engaging means may be adjusted. In this way, the attitude of a mask attached to the fitting may be adjusted independently of the attitude of the fitting relative to the helmet, which may result in increased comfort for a wearer.

Preferably, the fitting comprises a plurality of independently-moveable webbing receiving means. This may result in greater security in the attitude of the mask relative to the fitting.

The webbing receiving means preferably comprises a disc rotatably-mounted in the fitting, the disk comprising a slot for receiving webbing and/or an arcuate insert

slidably mounted in an arcuate slot in the fitting, the insert comprising a further slot for receiving webbing.

Specific embodiments will now be described, by way of example only, with reference to the accompanying drawings, in which:

Figure 1 shows an impact-resistant and energy absorbing helmet in use;

Figure 2 is a part section through the helmet shown in Figure 1 with mask, visor and helmet-mounted equipment removed and showing a personalised cap;

Figure 3 shows a first hood adapted to be worn under the helmet shown in Figures 1 and 2;

Figure 4 shows a second hood adapted to be worn under the helmet shown in Figures 1 and 2, illustrating the removable goggle and mask portion of the hood;

Figure 5 shows a variant of the hood shown in Figure 4;

Figure 6 shows a mechanism by which a mask may be fitted in a mouth and nose portion of the hoods shown in Figures 4 and 5;

Figure 7 shows a further hood adapted to be worn over a helmet;

Figure 8 illustrates a helmet having a raisable visor, showing the visor in its raised position in dotted lines;

Figure 9 shows the hood of Figure 7 with the seal released and the visor of the helmet raised;

Figure 10 illustrates a hood having a sleeve for hoses for providing air to a respirator mask and demisting air;

Figure 11 is a schematic representation of a connection assembly at the distal end of the sleeve for connecting hoses running through the sleeve to an air supply of an aircraft;

Figure 12 is a part section through a first hose;

Figure 13 is shows the structural helices of a second hose;

Figure 14 shows a mask suitable for use with the hoods and hoses shown in the previous Figures;

Figure 15 is a simplified schematic representation of a valve forming part of the mask shown in Figure 14;

Figure 16 shows a first embodiment of a fitting for attaching a mask to a helmet or an under-helmet hood; and

Figure 17 shows a second embodiment of a fitting.

A first example of a system allowing a wearer of a helmet also to wear an environmental protection hood will first be described, in which the hood is to be worn under the helmet. A second example in which the hood is worn over the helmet will then be described, followed by further features which may be provided in connection with either example.

Figure 1 shows an impact-resistant and energy-absorbing helmet 2. A respiratory mask 4 is provided to allow the user to breathe in conditions where this would otherwise be difficult or impossible, and a visor 6 depending from a helmet-mounted display unit or boss 7 is provided to shield the wearer's eyes.

Figure 2 is a schematic section through the helmet 2 with the mask 4, boss 7 and visor 6 removed,. The helmet comprises an outer shell 8 covering a personalised

cap 10 comprising a crown portion 12 (to cover the crown of the head of a wearer of the helmet) and a brow portion 14 (to cover the brow). The crown and brow portions 12, 14 of the cap 10 are contiguous with one another. The outer surfaces of the cap 10 are profiled to conform to the profile of the inner surface of the outer shell 8, such that relative movement of the cap 10 and the outer shell 8, when in use, is minimised.

The crown and brow portions 12, 14 of the cap 10 are formed in accordance with data relating to the size and shape of the head of an intended user of the helmet obtained by gauging the profile of the wearer's head, for example by a measurement device operating by direct measurement or by a non-contact method such as optical scanning, without an environmental protection hood so that when the wearer for whom the helmet 2 was constructed wears the helmet without such a hood, it fits closely to his head, and the possibility of movement of the helmet relative to the head is minimized.

In addition, an alternative brow portion 14' (shown in dotted lines) of the cap 10 is provided. The outer surface of this alternative brow portion is also profiled to conform to the profile of the inner surface of the outer shell 8. However, the inner surface of the alternative brow portion 14' is formed in accordance with data relating to the size and shape of the head of the intended user of the helmet while wearing an environmental protection hood so that when the wearer wears the helmet with such a hood, the helmet fits closely to his head and, again, the possibility of movement of the helmet relative to the head is minimized. In the preferred embodiment, the alternative brow portion 14' is shaped to accommodate a frame of the environmental protection hood (described in more detail below).

At the interface between the crown and brow portions 12, 14 of the cap 10, the portions engage with one another or interlock to inhibit relative movement of the portions during use of the helmet. However, the portions may be removed from the outer shell 8 independently of one another; in particular, the brow portions 14, 14' of the cap may be interchanged without disturbing the crown portion.

Both portions of the cap 10 are formed of an energy or impact absorbing material (for example, expanded polystyrene) in order to protect the wearer from injury in the event of an impact. Furthermore, the crown portion 12 of the cap is thicker than the brow portion 14, 14' and, in a particular embodiment, the portions are formed of different energy or impact absorbing materials having different impact properties.

The outer shell 8 of the helmet also comprises crown and brow portions 16, 18 respectively, which correspond approximately to the crown and brow portions of the cap 10. The outer radius of the shell brow portion 18 is less than that of the shell crown portion to permit the attachment over the brow portion of a helmet mounted display equipment. In conjunction with a thinner brow portion 14, 14' of the cap 10, this allows the display equipment to be mounted close to the eyes of the wearer of the helmet.

In the preferred embodiment, the measurement device by means of which data relating to the size and head of the intended wearer of the helmet is a non-contact device (for example which scans the head of the wearer of the helmet optically). In order to ensure accurate fitting of the helmet 2 and control over the attitude at which it sits upon the head of the wearer, the positions of the eyes of the wearer relative to one another and to the measured portion of his head are determined.

An environmental protection hood for use in conjunction with a helmet having the above-described personalised cap will now be described.

Figure 3 shows an environmental protection hood 40 to be worn under a helmet. The hood is formed of a flexible material and is adapted to be closing-fitting to the head of a wearer.

An aperture 42 in the flexible material is provided in a region of the hood intended to be situated in front of the eyes of the user when the hood is in use. The material of the hood at the periphery of the aperture is attached to a rigid frame 44, by means of which the shape of the aperture is maintained. The aperture is sealed by

a removable clear window 46 through which a wearer of the hood may see.

Upper and lower clips 48, 50 are provided on the frame adjacent the brow and the cheeks respectively of a wearer of the hood for engaging with clips in a helmet such that the frame and the window are positively located relative to the helmet. In a preferred embodiment, the lower clips 50 are adapted to engage with mask receivers in a helmet under which the hood is worn (described in further detail below with reference to Figure 6).

The hood further comprises a mask region 52, intended to be situated adjacent a respiratory mask worn by the wearer of the hood, such that the mask is enclosed with the head of the wearer. At sides of the mask region, that is to say in locations on the inner surface of the hood, adjacent the cheeks or the ears of a wearer of the hood, there are provided receivers for receiving bayonets for locating the mask adjacent the mouth of the wearer. While the receivers may be attached to the frame, in a preferred embodiment the receivers are not attached to the frame and the flexibility of the material between the receivers and the window allows the receivers to move relative to the window.

In a further embodiment, shown in Figure 4, the mask region of the hood is removable. In this embodiment, the frame 44 (the main frame) additionally defines an aperture 54 in the region of the mouth and nose of the wearer. The mask region of the hood comprises a further frame 56 (the mask frame) having a shape corresponding to that of the main frame such that the mask frame seals against the main frame. Clips 57 are provided on the mask frame 56 which engage with clips 47 on the main frame 44 to positively locate and seal the mask frame against the main frame. In this embodiment, the lower clips 50 are provided on the mask frame 56.

In a variant of this embodiment (shown in Figure 5), the aperture 54 in the region of the mouth and nose of the wearer is not formed by the main frame 44 but by a secondary frame 45.

Turning to Figure 6, a mechanism for locating the mask within the hood shown in Figure 5 will be described. The mask region 52 of the hood comprises bayonets 50 for engaging with a helmet and a mask. The bayonets 50 extend through the mask region of the hood, which is sealed around them, to provide clips on the inside and the outside of the hood. On the outer surface of the mask 52, the bayonets 50 comprise clips 50' which are adapted to engage with the receivers in a helmet to which the bayonets 5 of the mask 4 are ordinarily attached when an under-helmet hood is not worn. The bayonets 5 of the mask 4 (which may be the same mask which is used when a hood is not necessary and which may be custom fit to a wearer) are removed, and the mask instead engages with the interior clips 50" of the hood bayonets 50. The air hose 104 attached to the mask 4 is inserted into the sleeve 102 as described above.

As indicated above, in an alternative embodiment, the interior clips 50" and the exterior clips 50' are not rigidly located relative to one another, in order to allow relative movement of the mask and the helmet.

The second example will now be described.

As indicated above, in this example, the hood is worn over a helmet for example as shown in Figure 1.

Figure 7 shows a hood 80 being worn over a helmet (such as that shown schematically in Figure 8). The hood is formed largely of a flexible material which allows the hood conform to the shape of the helmet over which it is worn. A transparent window or visor 82 is provided in an eye region of the hood, through which the wearer of the hood may see. A releasable seal 84 is provided along or adjacent the lower edge of the visor 82. By releasing this seal, an opening may be made in the hood.

Turning to Figure 8 an example of a helmet with which the hood may be worn comprises a head portion 92 and a helmet-mounted display unit or boss 94 mounted

on the head portion at pivots 96 so that the boss may be raised from a first position to a second position (shown in dotted lines). A transparent visor 98 depends from the boss 94.

When the hood 80 is worn with such a helmet 90, the hood visor 82 and the helmet visor 98 are both situated in front of the eyes of the wearer. Adjacent the periphery of the hood visor 82 are provided clips which engage with the boss 94 to locate the visors 82, 98 in relation to one another. Thus, when the seal 84 is released, both the hood visor 82 and the helmet visor 98 may be raised together, as shown in Figure 9.

Turning to Figure 10, a system for providing air to a respiratory mask worn together with the hood will now be described. This system is applicable equally to the under-helmet hood 40 and the over-helmet hood 80 described above.

The hood 100 comprises a sleeve 102 formed of the same flexible material as the main body of the hood. A hose 104 for feeding air to a respiratory mask 105 worn by the wearer of the hood is inserted into the sleeve and the proximal end of the hose 104 is connected to the mask in a known manner.

Also running through the sleeve is a further hose 106 for supplying demisting air to the window 101 of the hood 100.

At the distal end of the sleeve is provided a connection assembly 110 (see Figure 11). The connection assembly comprises a socket 112 on the inside of the sleeve in flow communication with a plug 114 on the outside of the sleeve. The socket 112 is adapted to receive and retain the hose 104 for supplying air to the mask 105 (which may, for example, be as currently used to supply air to respiratory masks in aircraft) and the further hose 106 for supplying demisting air. The sleeve is sealed around the connection assembly 110, but air may pass into the hoses from the air supply of an aircraft via the connection assembly. In this way, air may be supplied to the mask 105 by means of a hose which is enclosed in the hood. In the case of

compressed or stretched. For example, in the arrangement shown in Figure 10, the helices are of identical cross-section and identical pitch.

A mask will now be described which may be used in conjunction with the above-described systems.

With reference to Figure 14, the mask comprises a rigid unit 240 which houses all of the common elements of the respirator, such as an inspiratory valve unit, an expiratory valve and a communications microphone. The unit 240 is connected to a supply hose 242 for the supply of breathing gas to a wearer, such as an airman. The unit 240 is formed by injection moulding of a thermoplastics material such as nylon, and is moulded to have interior surfaces of the mask which serve as valve seats for the inspiratory valve and expiratory valves, and cavities or depressions which serve as pressure chambers for the valves.

Figure 15 is a simplified schematic representation showing a valve 210 in the wall of the unit 240. The valve comprises a cavity 262 defined in the wall of the unit 240, which serves as a chamber of the valve. The chamber is closed by a cover 264 which screws into the opening in the chamber 262. The cover comprises openings 266 to allow exhalate into the chamber, and a side wall of the chamber comprises a further opening 268 to allow the exhalate to leave the chamber.

Opposing depressions in the cover 270 and the wall of the unit 240 serve to locate a shaft 272 upon which is mounted a valve disc 274. The disc 274 is slidable along the shaft 272 and is urged by a spring 276 towards the cover 264 where it seals the openings 266, preventing air from outside the mask entering the mask via the chamber 262.

While the valve shown is simplified in order to provide a clear example, the principle is equally applicable to inspiratory and expiratory valves, including valves through which air is to be breathed under pressure.

The unit 240 is a common element of the breathing mask, in that it is supplied in common to many airmen regardless of facial size and/or shape. The unit 240 is connected to a pre-formed unit 244 having a flexible body moulded from, for example, rubber material, for sealing to an airman's face. The inner surface of the body may be moulded with features 247 which prevent the reflex edge of the sealing surface of the unit from becoming inverted under pressure.

The pre-formed unit 244 is a sized component, which may also be shaped to suit differing racial characteristics, selected from a range of such units 244 according to the size and/or shape of the wearer's face. The units 240, 244 are assembled by threading the supply hose 242 though aperture 248 in the unit 244 and drawing the unit 244 around the unit 240 so that lip 250 of the unit 244 engages the raised edge 252 of the unit 240. A rigid clamping unit 254, which may be formed from moulded plastics material, is, like the unit 244, a sized component and selected from a range of similar units in accordance with the particular unit 244 chosen for the airman. The clamping unit 254 is assembled to the units 240, 244 by similarly threading the supply hose 242 through the aperture 256 and drawing the clamping unit 254 around unit 240 to engage the unit 244. The clamping unit 254 may be secured by a snap-fit or by any conventional fastening.

Finally, fittings to allow a mask to be located within a helmet or an under-helmet hood are described with reference to Figures 16 and 17.

Figure 16 shows a first embodiment of a fitting which comprises an elongate bayonet assembly 302 adapted to engage with receivers in a helmet, and a steelwork portion 304. The steelwork portion 304 comprises two rotatably mounted discs 306, each having a slot 307 through which may be passed webbing 308 for attaching the fitting to the mask. Figure 16A shows the fitting with the discs oriented such that webbing passing through the discs extends in a direction parallel to the axis of the bayonet assembly. In Figure 16B, the same fitting is shown with the discs rotated slightly so that the webbing extends away from the axis of the bayonet assembly 302.

Figure 17 shows a second embodiment of a fitting 300', similar to that shown in Figure 16 with the exception that, instead of discs, the steelwork portion 304 comprises arcuate inserts 310 slidably mounted in arcuate slots 312 having the same radius of curvature as the inserts 310, such that they may slide between the ends of the slots 312. Each of the inserts 310 contains a further slot 314 through which may be passed webbing 308 for attaching the fitting to the mask. Figure 17A again shows the webbing extending in a direction parallel to the axis of the bayonet assembly 302. In Figure 17B, the same fitting 300' is shown with the inserts rotated slightly so that the webbing extends away from the axis of the bayonet assembly 302.

Each feature disclosed in the description, and/or the claims and drawings may be provided independently or in any appropriate combination. In particular, a feature of a subsidiary claim may be incorporated into a claim upon which it is not dependent.

CLAIMS

A1. A personalised cap for a helmet, the cap being bespoke to a specific wearer so as precisely to fit the helmet to the wearer's head, the cap comprising a crown portion and a separate brow portion, the crown and brow portion being contiguous with each other.

A2. A cap as claimed in claim A1, wherein the brow portion interlocks with the crown portion.

A3. A cap as claimed in claim A1 or claim A2 wherein at least one said portion is of impact or energy absorbing material.

A4. A cap as claimed in claim A3, wherein the brow portion is thinner than the crown portion.

A5. A cap as claimed in claim A4, wherein the brow portion is of a different impact or energy absorbing material to the crown portion.

A6. A helmet comprising a personalised cap as claimed in any of claims A1 to A5.

A7. A helmet as claimed in claim A6 when dependent from claim 4 or claim 5, wherein a brow portion of the helmet is of a smaller radius than a crown portion to permit the attachment over the brow portion of a helmet mounted display equipment.

A8. A helmet as claimed in claim A6 or claim A7, wherein the brow portion is removable from the helmet without disturbing the crown portion, whereby one brow portion can be substituted for another.

A9. A method of manufacturing a helmet comprising a personalised internal cap which positions the helmet on the wearer's heard, the method comprising a prior determination of the shape of the wearer's head by a measurement device followed

an environmental protection hood.

A17. A personalised cap, a kit of parts, a helmet and protective apparel substantially as hereinbefore described with reference to the accompanying drawings.

B1. An environmental protection hood for use under a protective helmet, comprising an aperture containing a window adjacent the periphery of which is provided means for engaging with an opening in a helmet.

B2. A hood as claimed in claim B1, wherein the window is reversibly removable from the hood.

B3. A hood as claimed in claim B2, comprising engaging means for engaging with and retaining the window.

B4. A hood as claimed in any of claims B1 to B3, further comprising a rigid frame.

B5. A hood as claimed in any of claims B1 to B4, further comprising fittings for engaging with a respiratory mask to locate such a mask when used by a wearer of the hood.

B6. A hood as claimed in any of claims B1 to B5, further comprising a removable mask portion.

B7. A hood as claimed in claim B6 when dependent upon claim B4, wherein the mask portion comprises a further rigid frame adapted to seal against the rigid frame.

B8. A mask as claimed in claim B6 or B7 when dependent upon claim B5, wherein the fittings are provided on the rigid frame of the mask portion.

C1. An environmental protection hood for use over a helmet and a respiratory

mask, the hood being adapted to entirely enclose the helmet and mask.

C2. A hood as claimed in claim C1, comprising an aperture having situated therein a window through which a wearer of the hood may see, a selectively releasable seal being provided adjacent an edge of the window such that an opening may be made in the hood.

C3. An environmental protection hood for use over a helmet, comprising an aperture having situated therein a window through which a wearer of the hood may see, a selectively releasable seal being provided adjacent an edge of the window such that an opening may be made in the hood.

C4. A hood as claimed in claim C2 or C3, further comprising means for engaging the window with a raisable front portion of a helmet, such that when the hood and helmet are worn together, the window and the front portion of the helmet may be raised and lowered together.

C5. A hood as claimed in any of claims C2 to C4, further comprising fittings for engaging with a respiratory mask to locate such a mask when used by a wearer of the hood.

C6. A hood according to any of claims B1 to B8 or C1 to C5 comprising a sleeve adapted to receive a hose for delivering air to a respiratory mask worn by a wearer of the hood.

C7. An environmental protection for use over a respiratory mask, comprising a sleeve adapted to receive a hose for delivering air to a respiratory mask worn by a wearer of the hood.

C8. A hood according to claim C6 or C7, wherein the sleeve is formed of the same material as the hood.

C9. A hood according to any of claims C6 to C8, wherein the distal end of the sleeve with respect to the aperture of the hood has means inside the sleeve for engaging with a hose by means of which the hose may be fed with air.

C10. A hood according to claim C9, wherein the distal end of the sleeve has means outside the sleeve for engaging with an air supply means of an aircraft, by means of which the hose may be fed with air.

C11. A hood as claimed in any of claims C6 to C10, wherein the sleeve further comprises at its distal end means for attaching a further hose for providing demisting air to the hood adjacent the head of a wearer.

C12. A hood according to claim C11, wherein a further hose for providing demisting air runs from the distal end of the sleeve to a portion of the hood adapted in use to be adjacent the head of a wearer.

D1. A respiratory mask air supply hose comprising enclosure means forming a conduit through which air may pass and structural means for maintaining the cross-section of the conduit, the enclosure means being formed of different material from that of the enclosure means.

D2. A hose as claimed in claim D1, wherein the enclosure means is formed of silicone rubber.

D3. A hose as claimed in claim D1 or D2, wherein the structural means is formed of an extruded thermoplastics material.

D4. A hose as claimed in any of claims D1 to D3, wherein the structural means comprising a left-handed helix and a right handed helix, both helices being coaxial with the conduit.

D5. An air supply hose comprising enclosure means forming a conduit through

which air may pass and structural means for maintaining the cross-section of the conduit, wherein the structural means comprising a left-handed helix and a right handed helix, both helices being coaxial with the conduit.

D6. A hose as claimed in claim D4 or D5, wherein the helices are arranged such that, when the hose is compressed or extended, substantially zero torque around the axis of the hose results.

D7. A hose as claimed in any of claims D4 to D6, wherein the structural means comprises a plurality of left-handed helices and/or a plurality of right-handed helices.

E1. A respirator mask comprising a first portion housing at least one valve and a second portion adapted to seal around the nose and mouth of a wearer, the first and second portions being formed of different materials.

E2. A mask as claimed in claim E1, wherein the first portion is formed of a thermoplastics material.

E3. A mask as claimed in claim E1 or E2, wherein the second portion is formed of a resilient material.

E4. A mask as claimed in any of claims E1 to E3, wherein the first portion has at least one integrally-formed portion of a valve.

E5. A mask comprising a housing portion having at least one integrally-formed portion of a valve.

E6. A mask as claimed in claim E4 or E5, wherein the at least one portion of a valve is a chamber of the valve.

E7. A mask as claimed in claim E4 or E5, wherein the at least one portion of a valve is a valve seat.

E8. A mask as claimed in any of claims E4 to E7, wherein the at least one portion of a valve is a portion of an inspiratory valve.

E9. A mask as claimed in any of claims E4 to E7, wherein the at least one portion of a valve is a portion of an expiratory valve.

F1. A fitting for attaching a respirator mask to a helmet comprising means for engaging with a helmet, and means for receiving webbing for attaching the fitting to the mask, the webbing receiving means being adapted to be movable such that the direction at which webbing in the receiving means extends from the fitting relative to the position of the helmet engaging means may be adjusted.

F2. A fitting as claimed in claim F1, comprising a plurality of independently-moveable webbing receiving means.

F3. A fitting as claimed in claim F1 or F2, wherein the webbing receiving means comprises a disc rotatably-mounted in the fitting, the disk comprising a slot for receiving webbing.

F4. A fitting as claimed in any of claims F1 to F3, wherein the webbing receiving means comprises an arcuate insert slidably mounted in an arcuate slot in the fitting, the insert comprising a further slot for receiving webbing.

G1. A hood substantially as hereinbefore described with reference to, and/or as illustrated in, the accompanying drawings.

G2. A hose substantially as hereinbefore described with reference to, and/or as illustrated in, the accompanying drawings.

G3. A mask substantially as hereinbefore described with reference to, and/or as illustrated in, the accompanying drawings.

G4. A fitting substantially as hereinbefore described with reference to, and/or as illustrated in, the accompanying drawings.

ABSTRACT

A personalised cap 10 for use with a protective helmet is disclosed, having crown and brow portions 12, 10. The brow portion 12 is removable independently of the crown portion 10, and an alternative brow portion 12' is provided for use when a environmental protection hood is to be worn under the helmet.

A hood for use over a helmet and a hose for use to provide air to a respiratory mask, a mask and fittings for attaching a mask to a helmet are also disclosed.

[Figure 2]

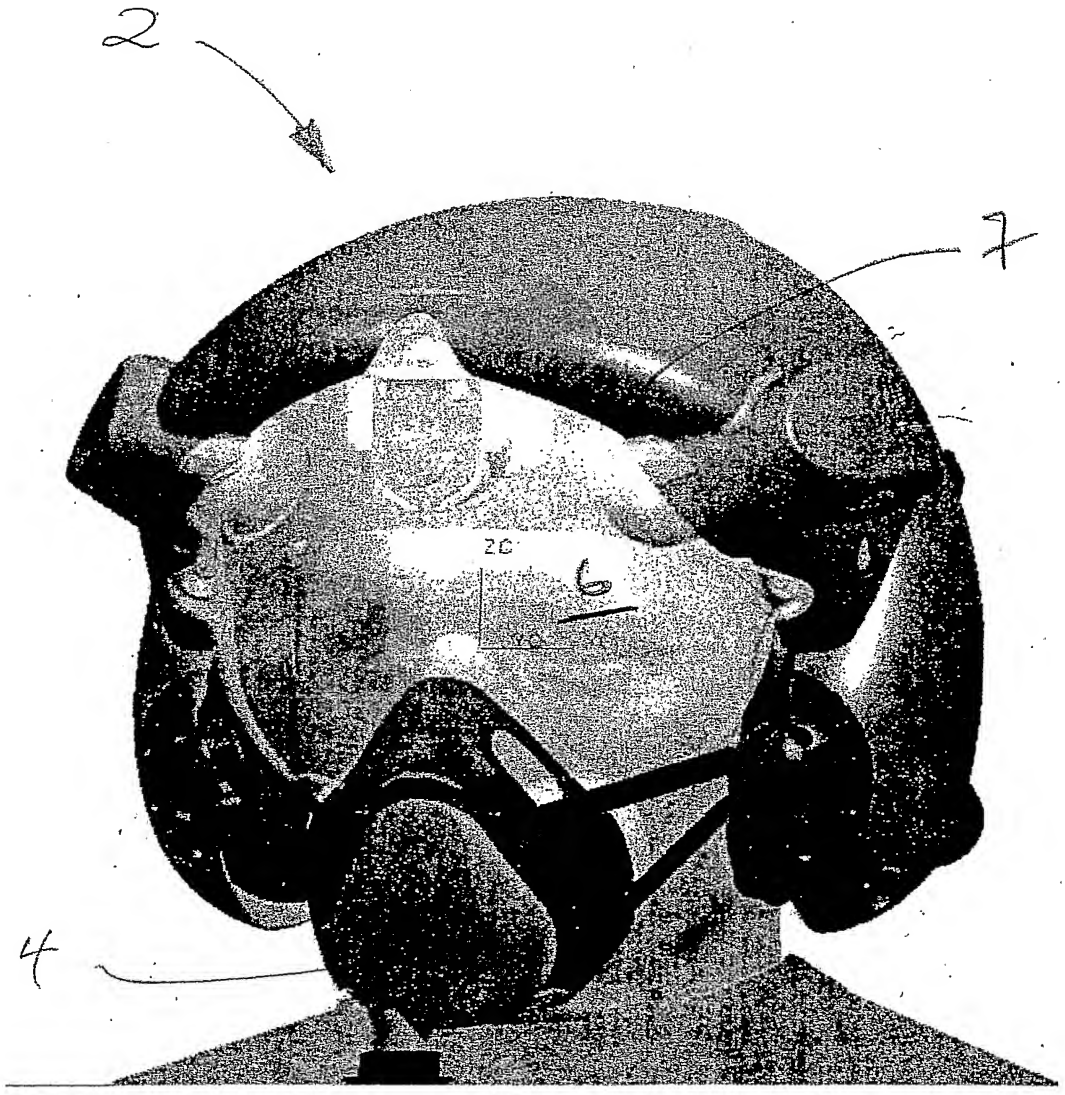

Fig. 1.

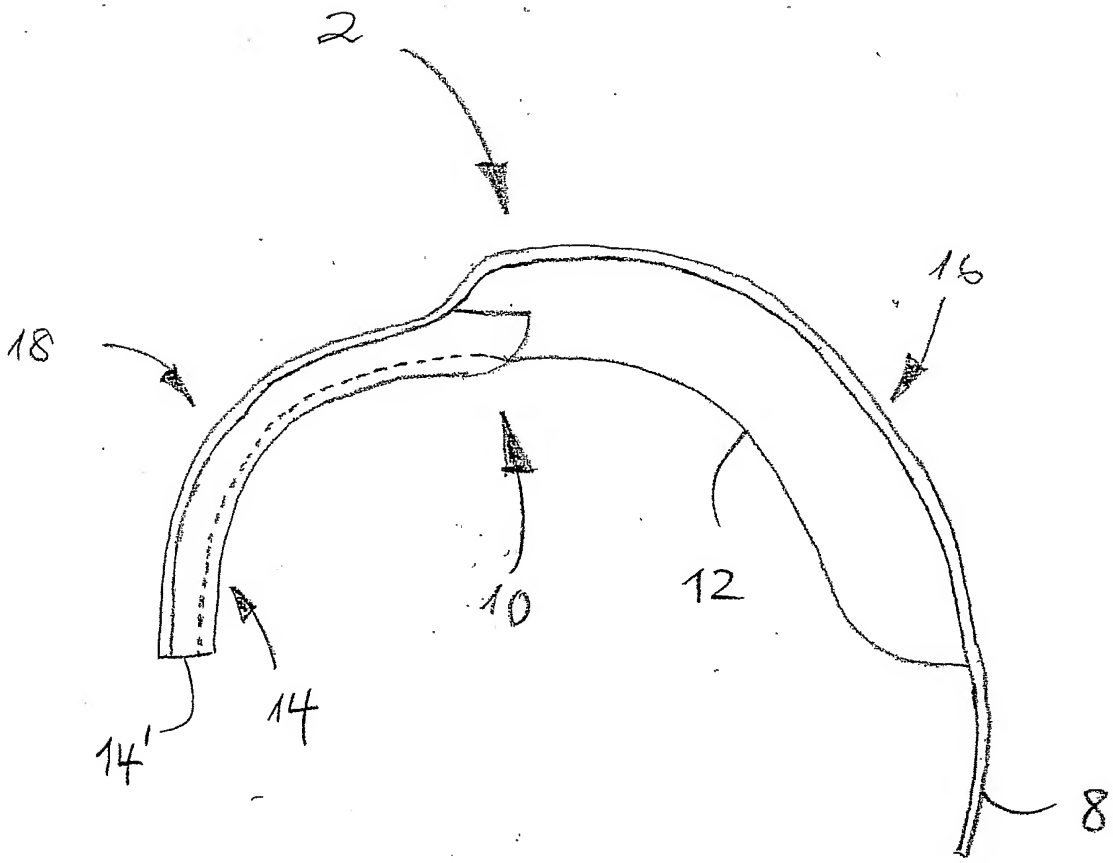

Fig. 2

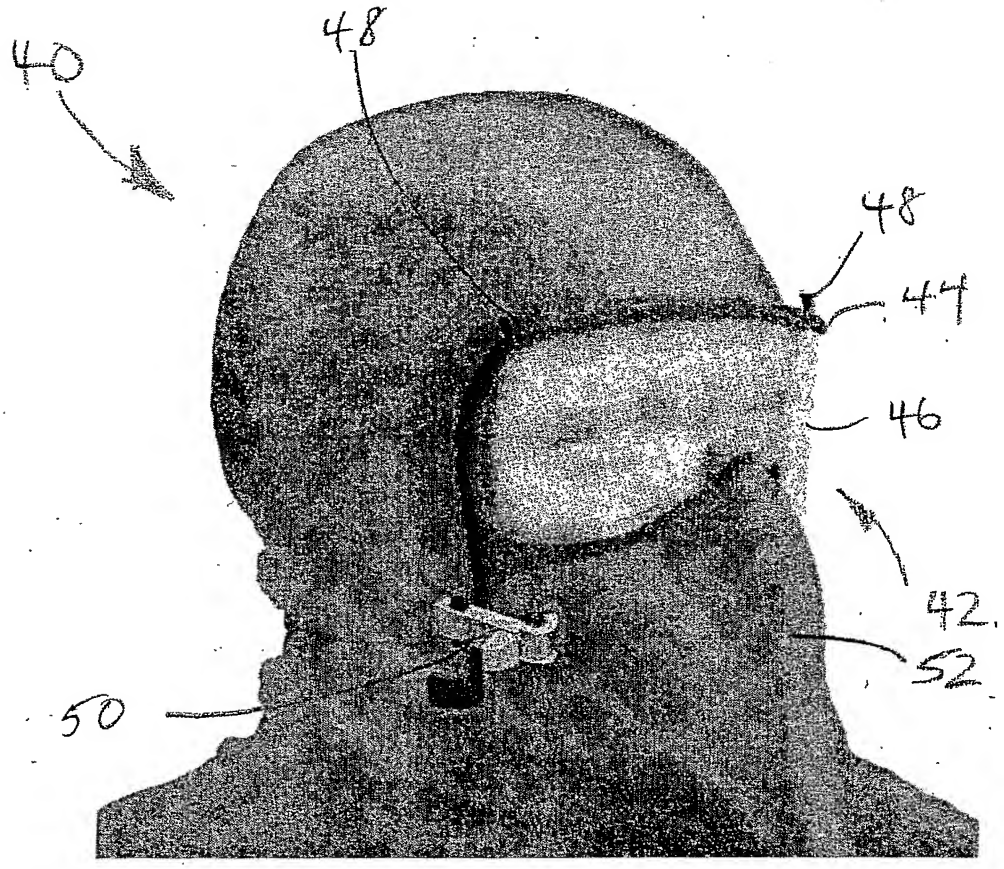

Fig. 3

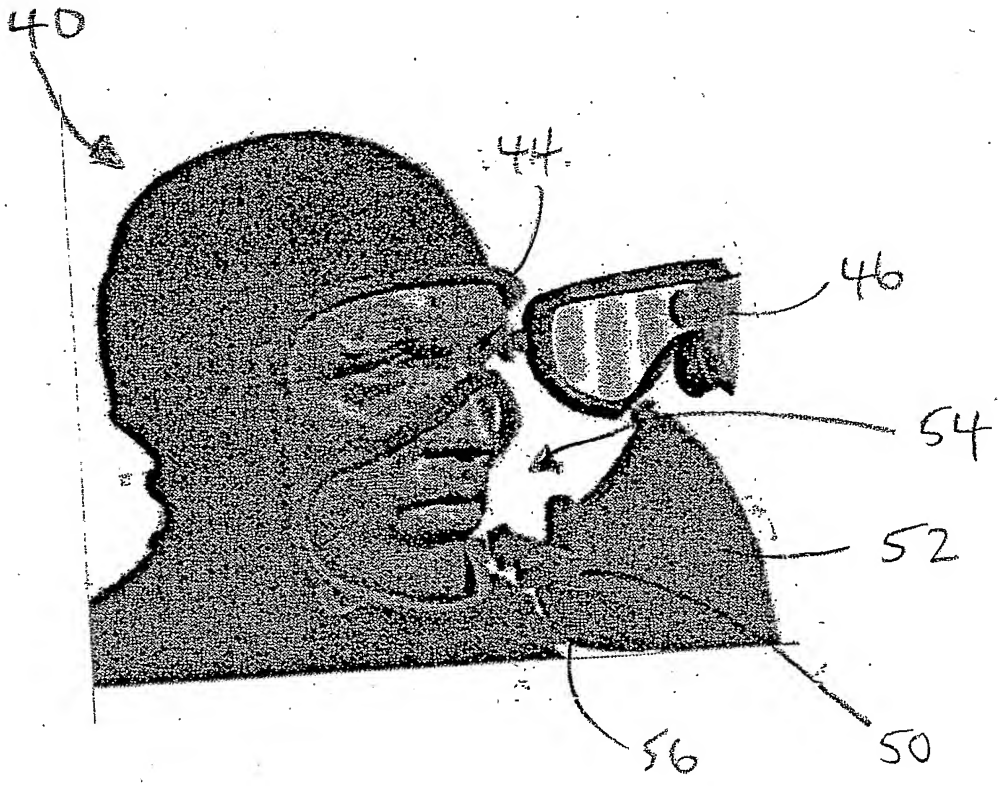

Fig. 4

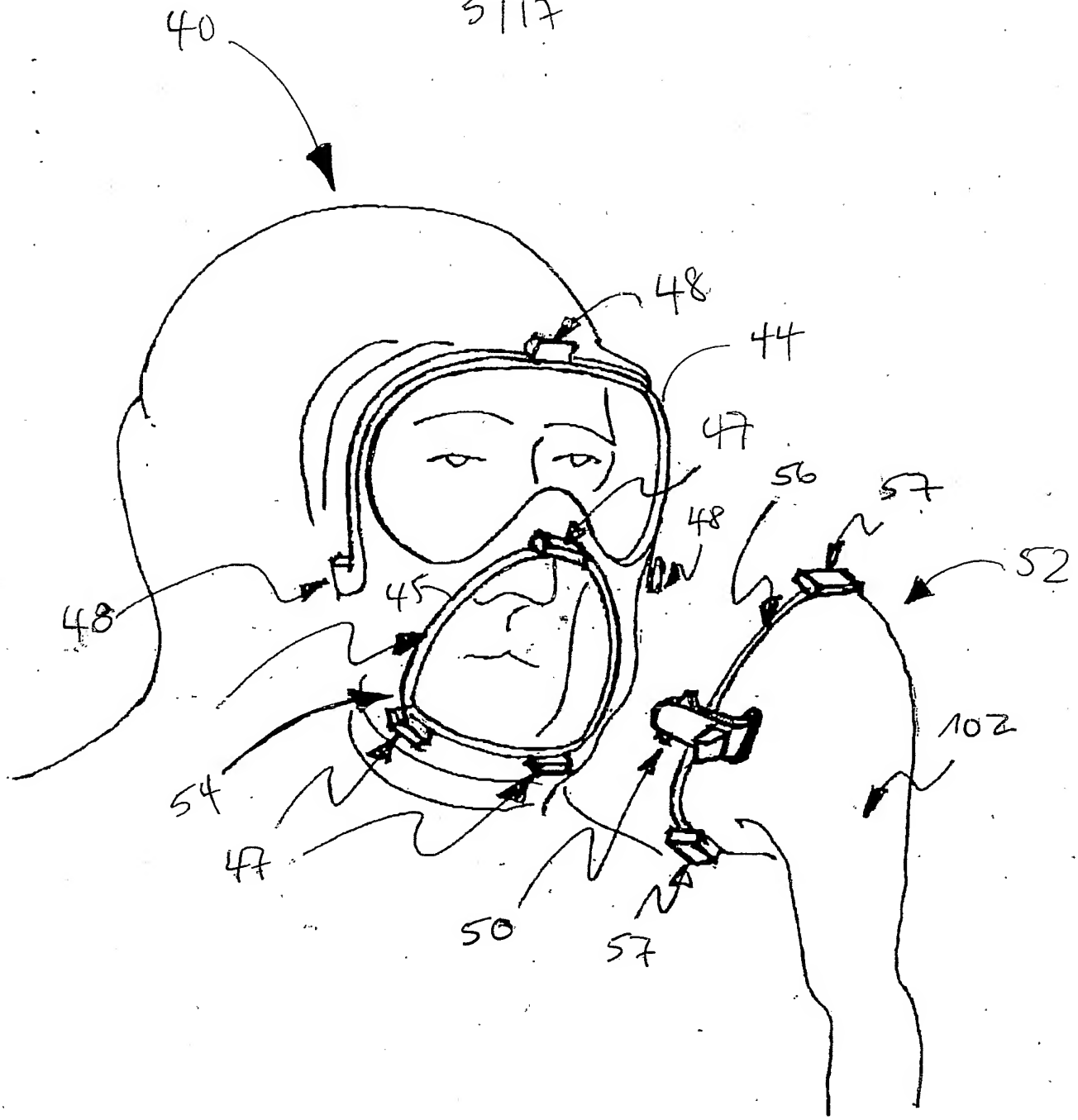

Fig. 5

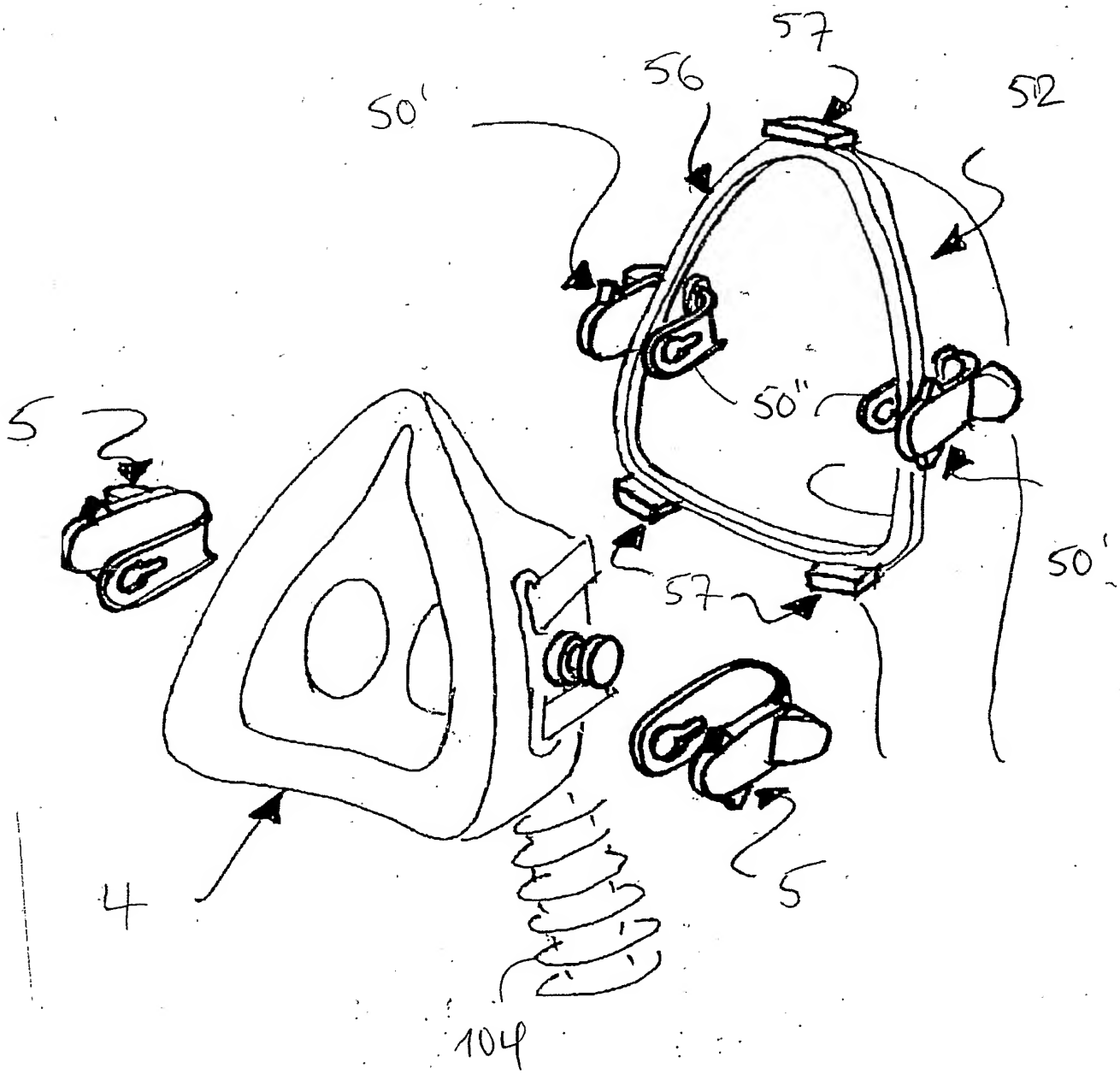

Fig. 6

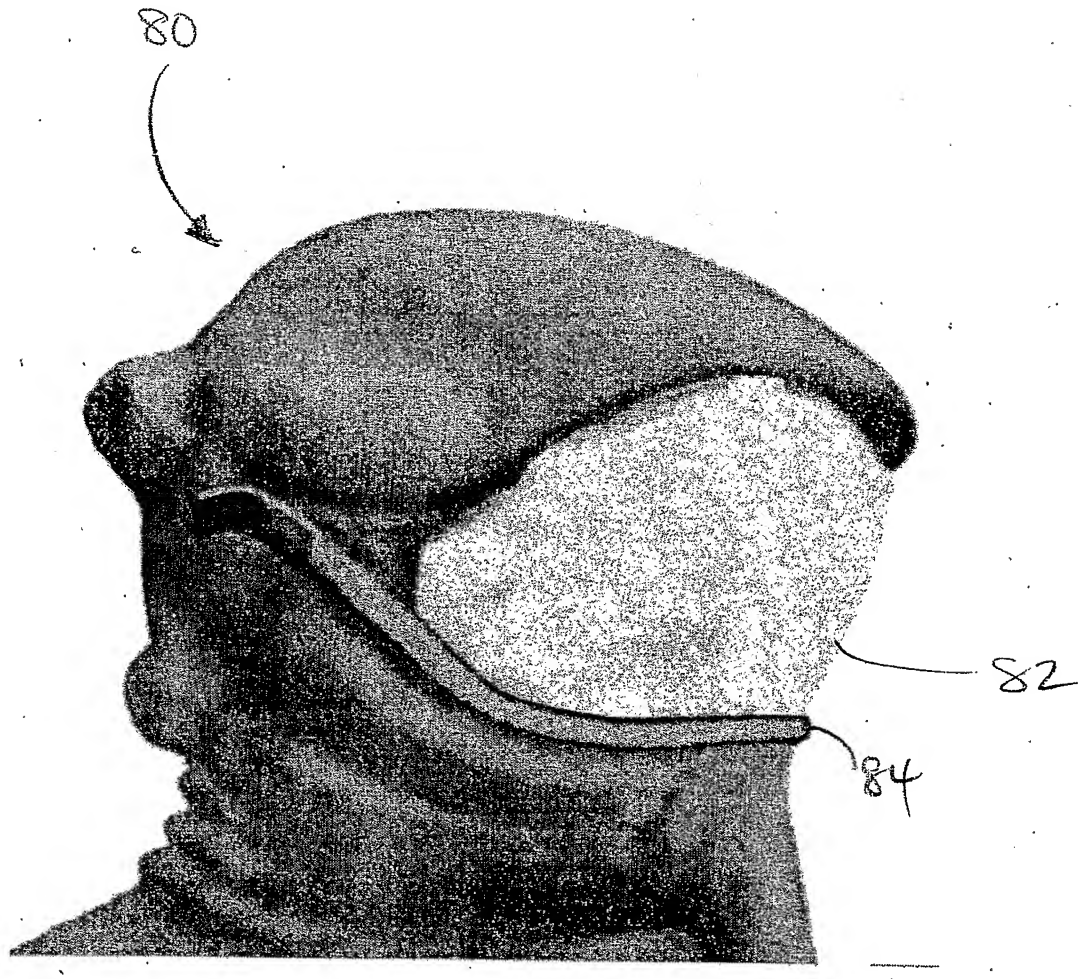

Fig. 7

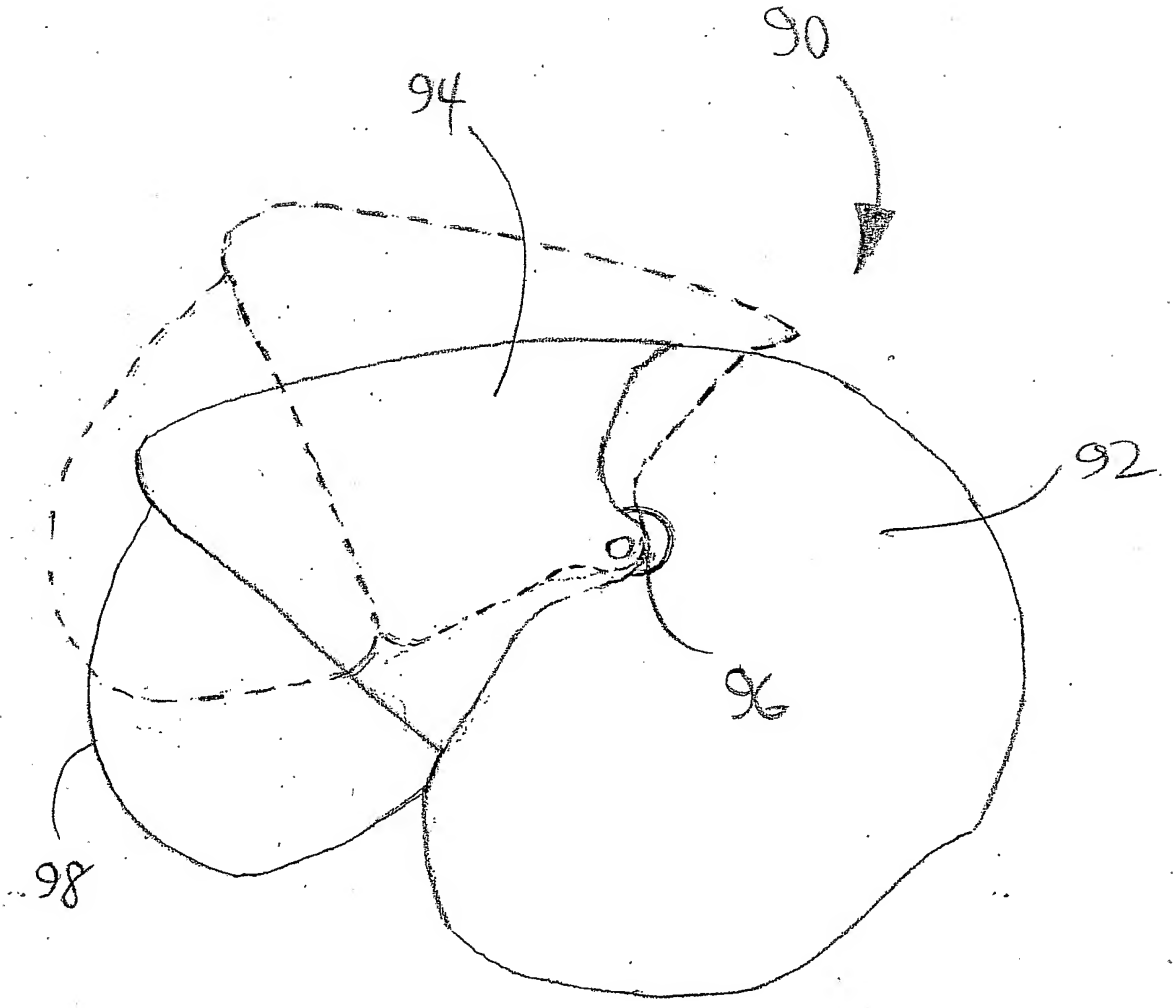

Fig. 8

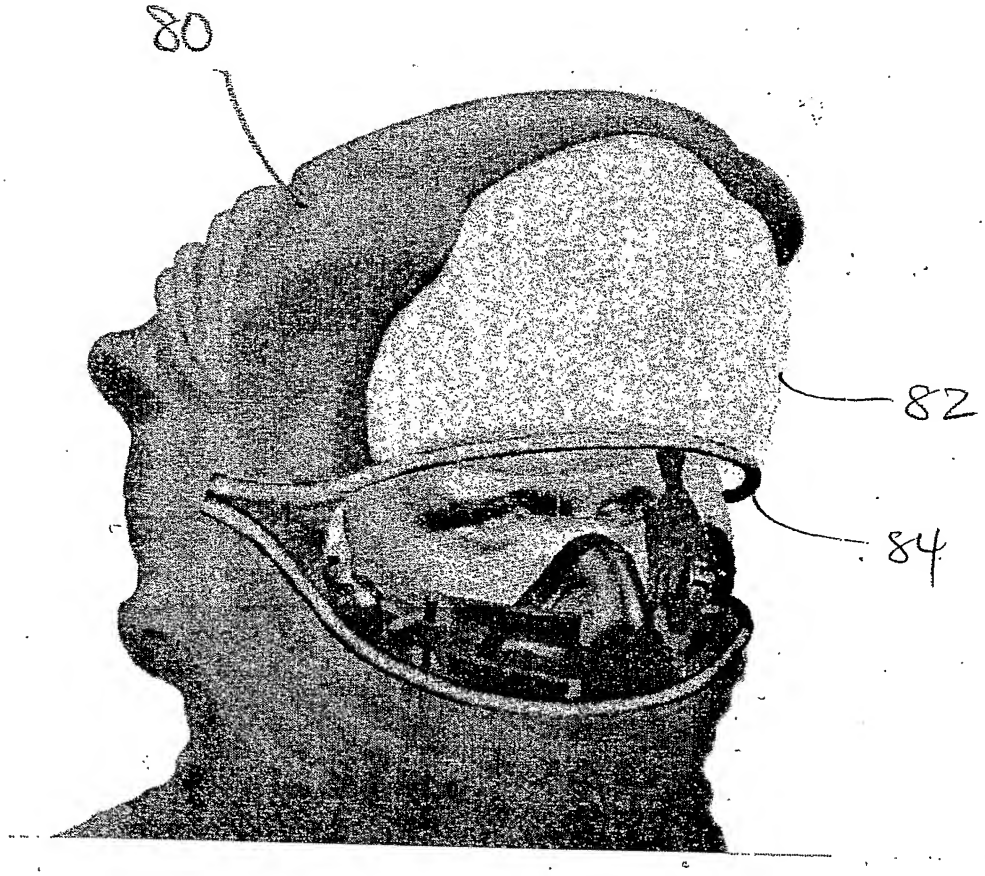

Fig. 9

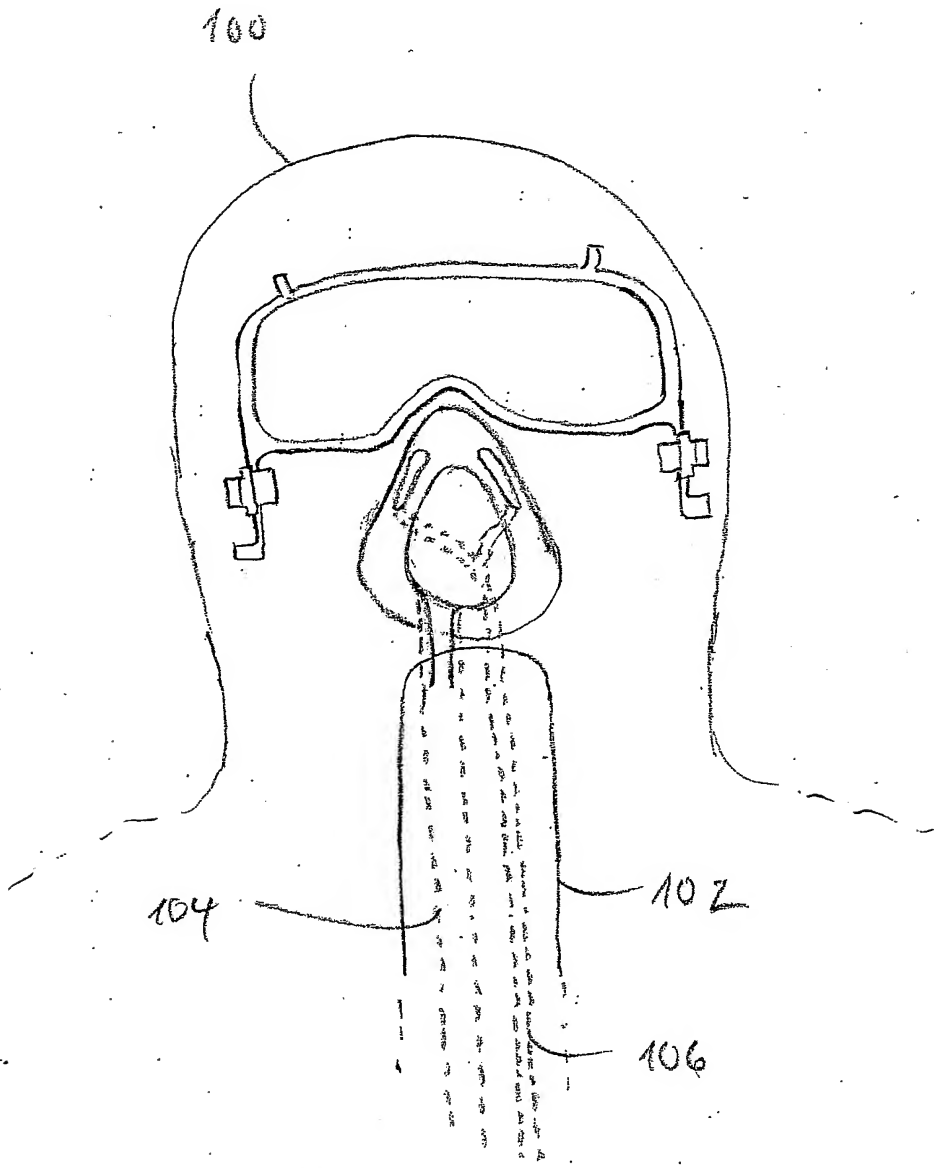

Fig. 10

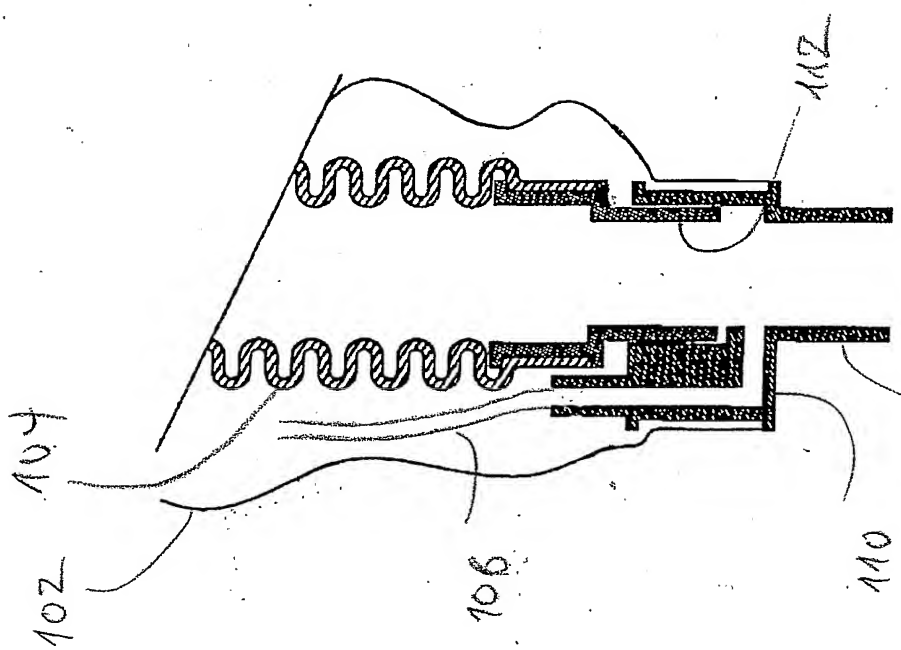

Fig. 11

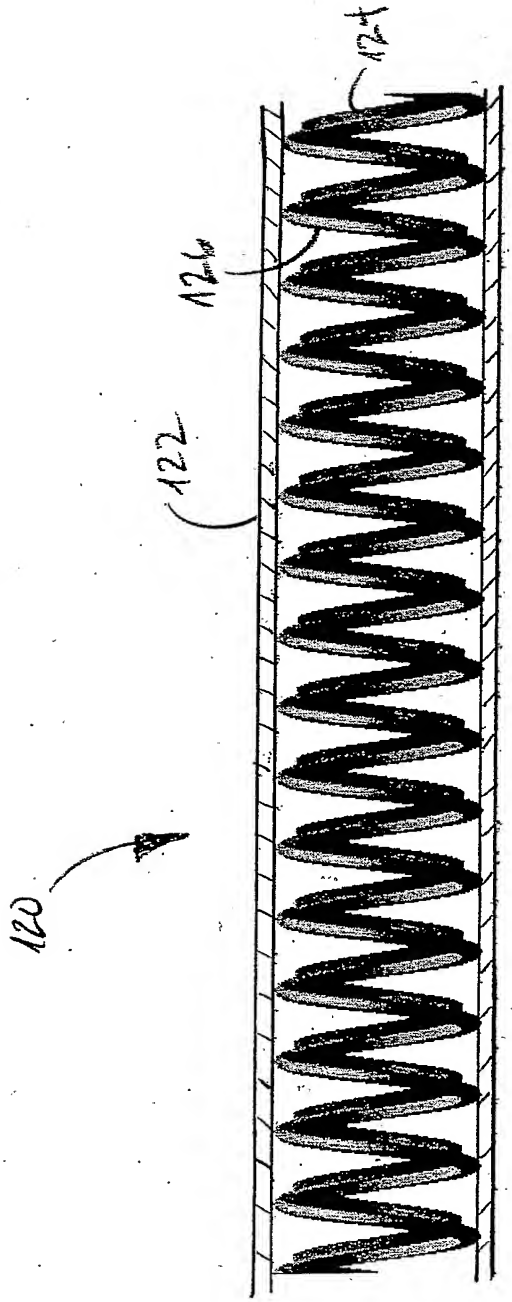

Fig. 12

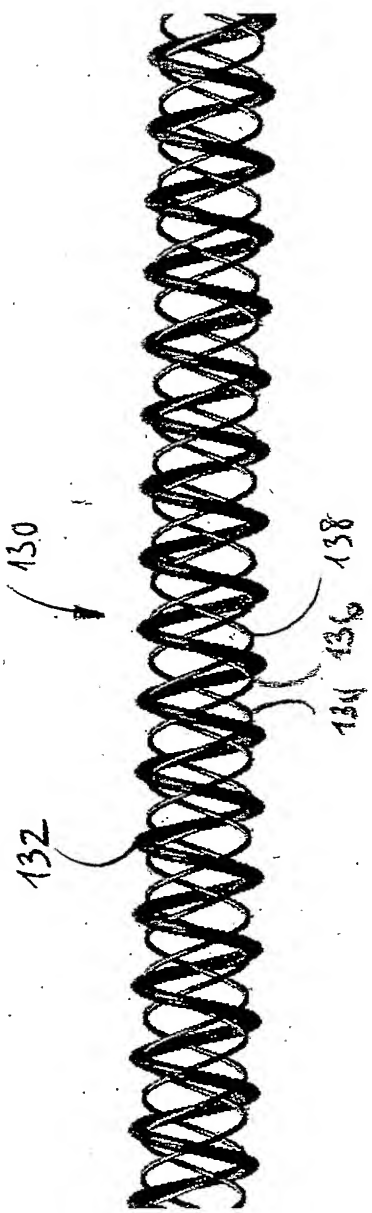

Fig. 13

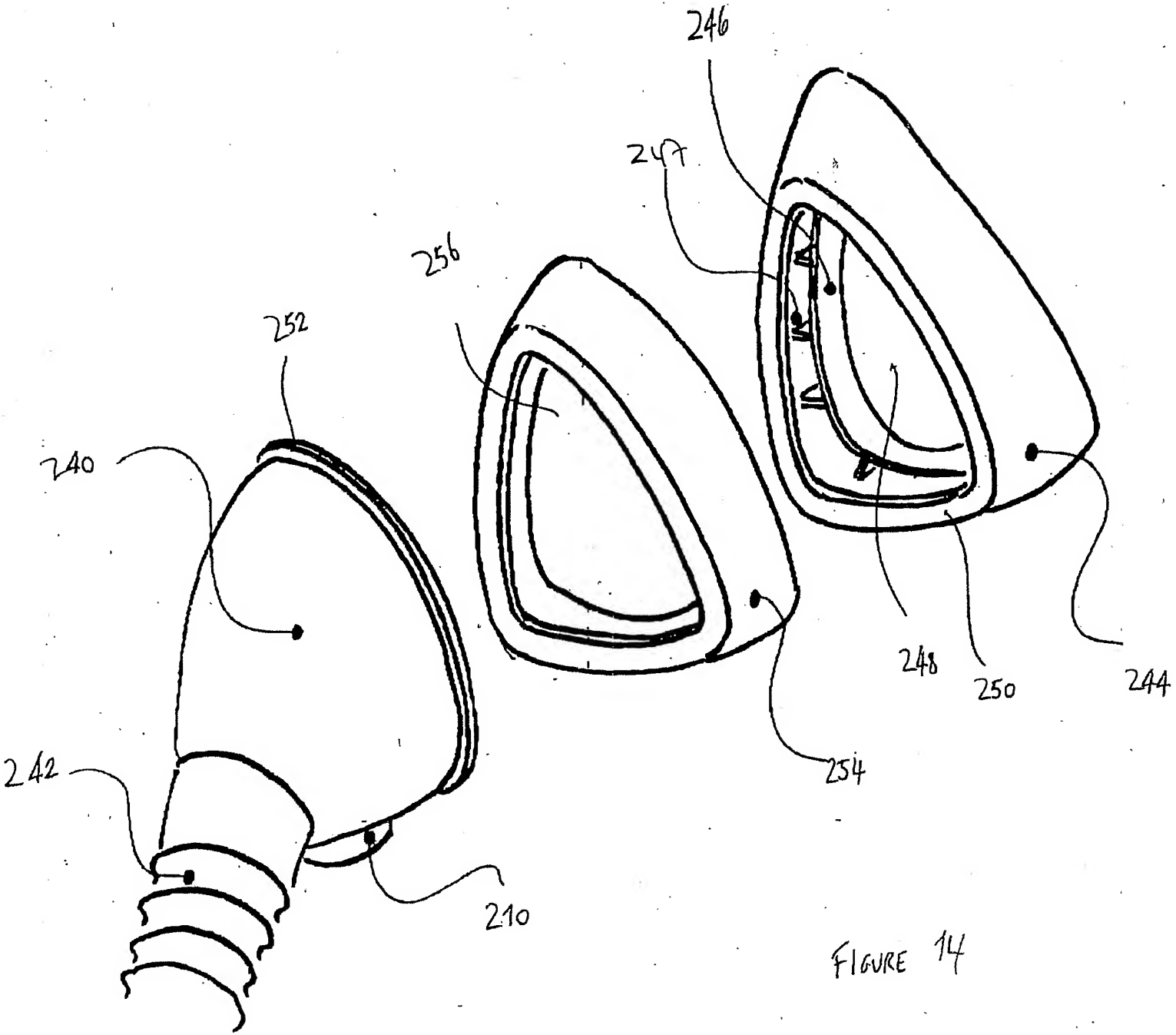

FIGURE 14

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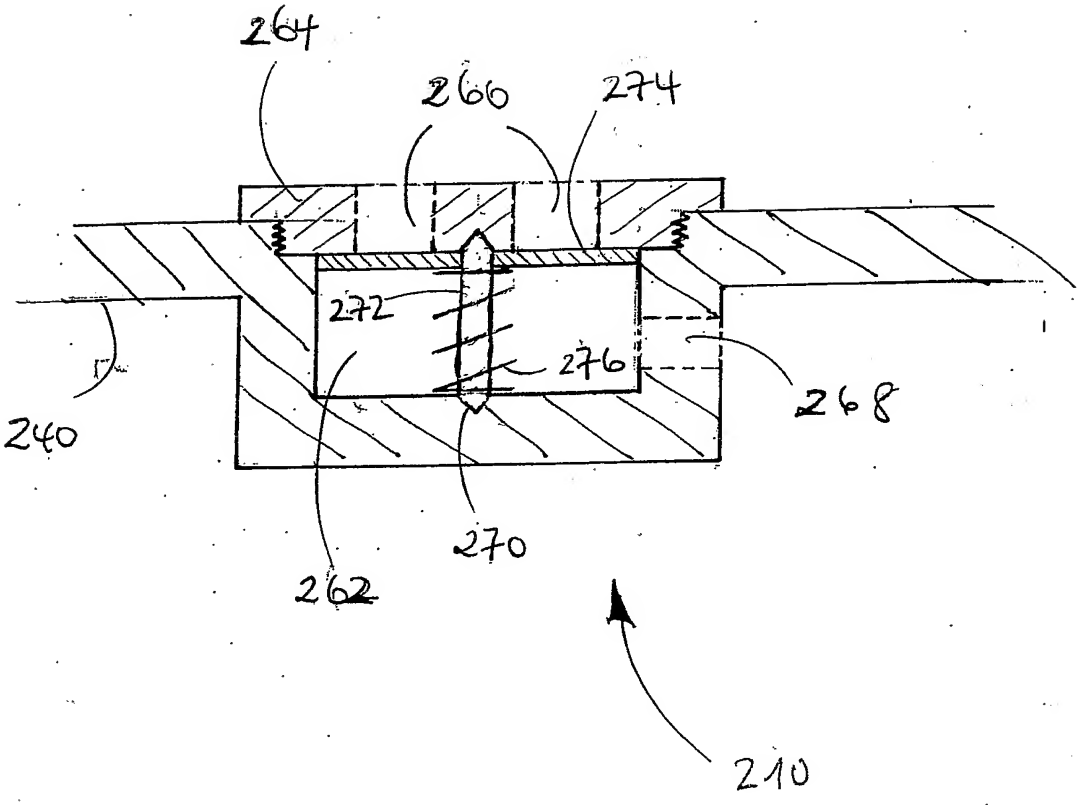
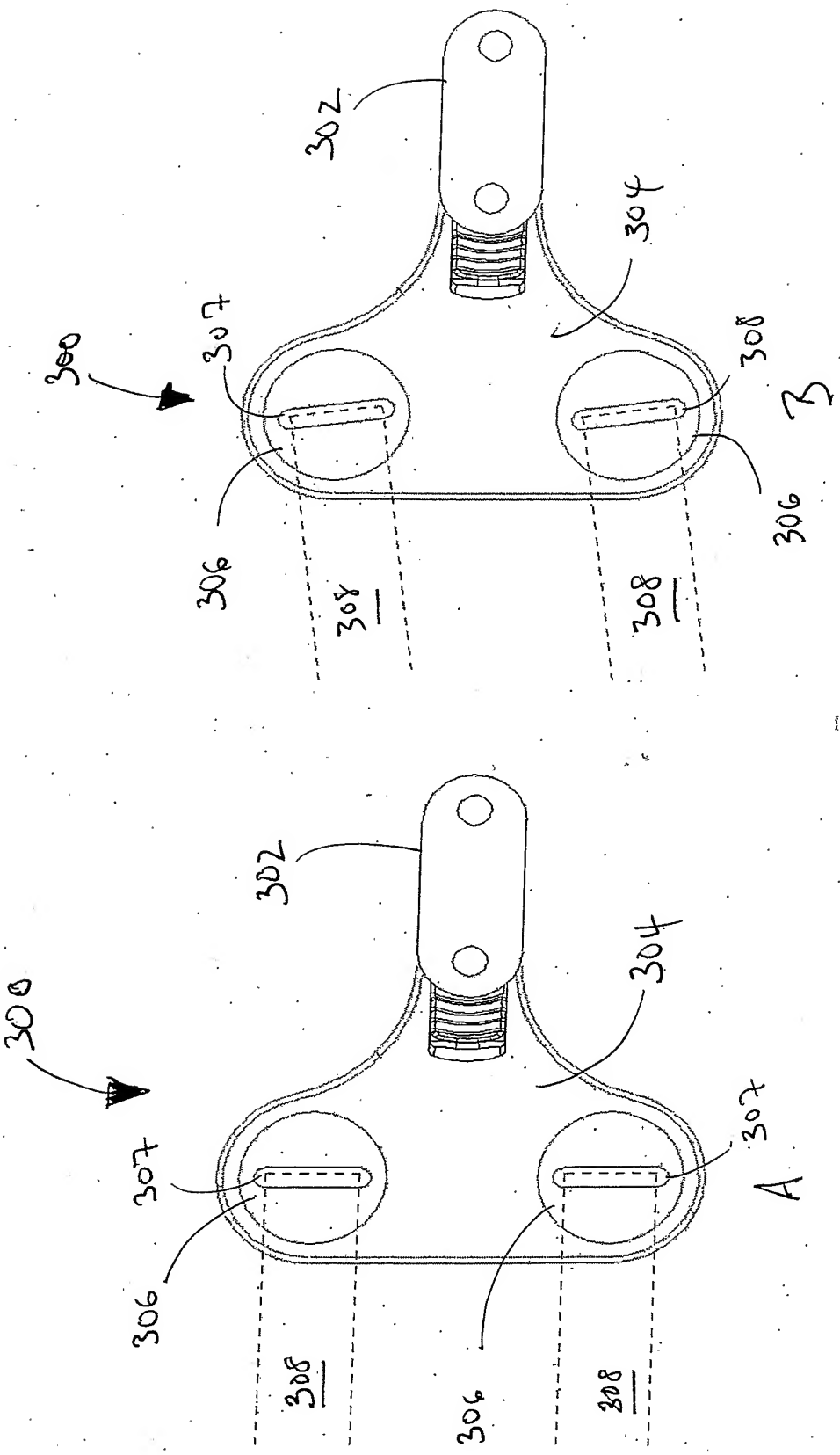


Fig. 15


302
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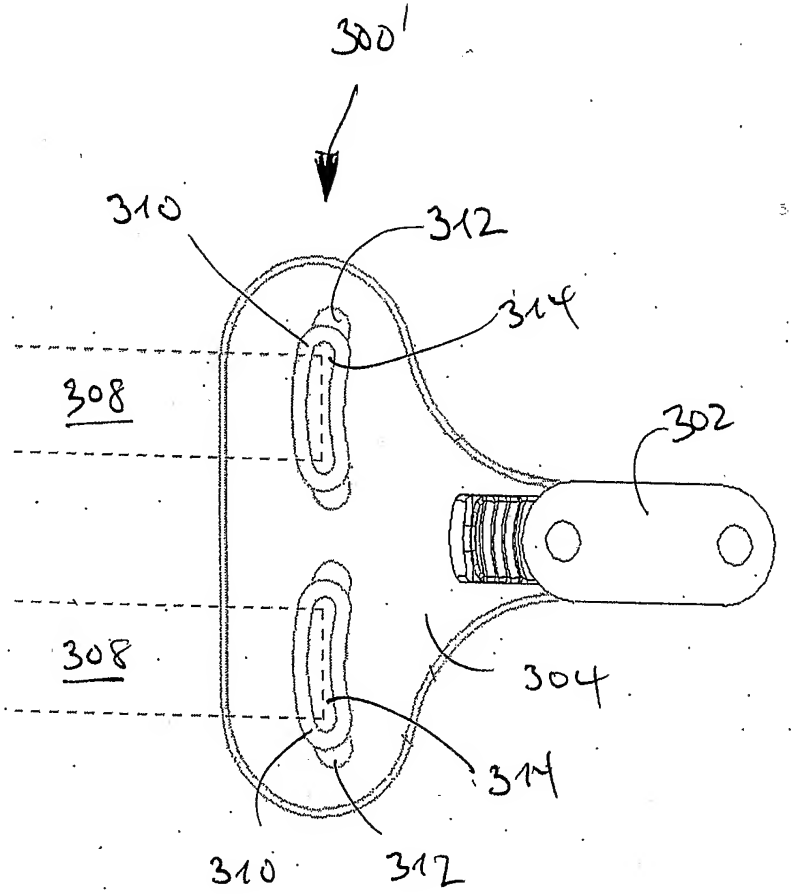
A

Fig 16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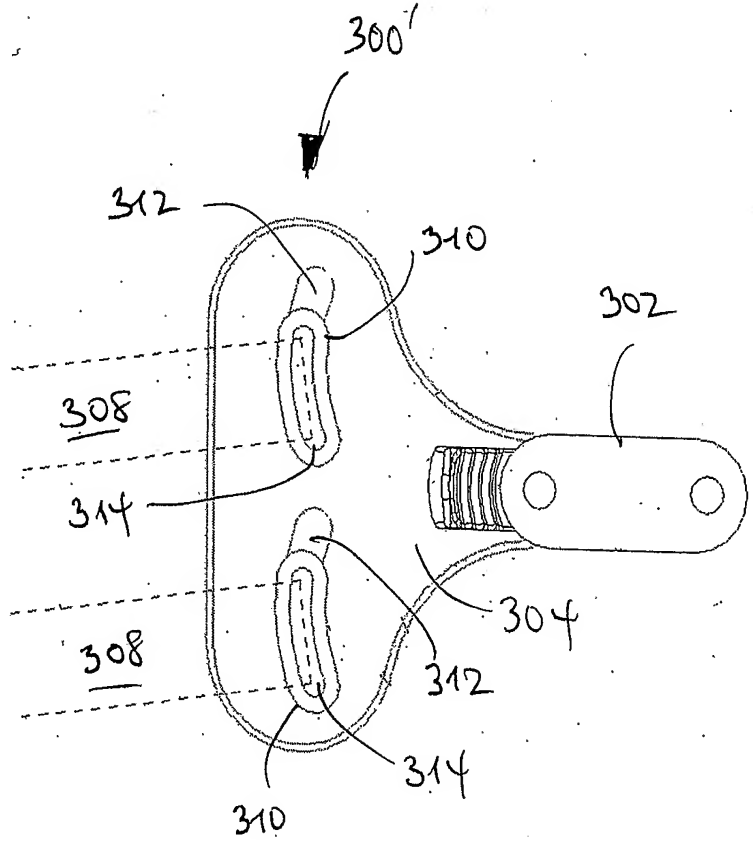
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Fig. 17.